Docket No.: S3-03P04867

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Before the Board of Patent Appeals and Interferences

Applic. No.	:	10/567,627	Confirmation No.: 1314
Inventor	:	Josef Aspelmayr, et al.	
Filed	:	July 5, 2006	
Title	:	Control Method and Control Device for an Actuator	
TC/A.U.	:	3753	
Examiner	:	William McCalister	
Customer No.	:	24131	

Hon. Commissioner for Patents
Alexandria, VA 22313-1450

BRIEF ON APPEAL

S i r :

This is an appeal from the final rejection in the Office action dated July 15, 2009, finally rejecting claims 10-28.

Appellants submit this *Brief on Appeal* including payment in the amount of $540.00 to cover the fee for filing the *Brief on Appeal*.

Real Party in Interest:

This application is assigned to Continental Automotive GmbH of München, Germany. The assignment will be submitted for recordation upon the termination of this appeal.

Related Appeals and Interferences:

No related appeals or interference proceedings are currently pending which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

Status of Claims:

Claims 10-28 are rejected and are under appeal. Claims 1-9 were cancelled in an amendment dated February 8, 2006.

Status of Amendments:

No claims were amended after the final Office action. *A Response under 37 CFR § 1.116* was filed on September 10, 2009. The Primary Examiner stated in an *Advisory Action* dated September 21, 2009 that the request for reconsideration had been considered but did not place the application in condition for allowance.

Summary of the Claimed Subject Matter:

The subject matter of each independent claim is described in the specification of the instant application. Examples explaining the subject matter defined in each of the independent claims, referring to the specification by page and line numbers, and to the drawings, are given below.

Independent claim 10 reads as follows:

A control method for a valve actuator [page 12, line 28; 6, Fig. 2A], which comprises the following steps:

charging and/or discharging the actuator [page 12, line 28; 6, Fig. 2A] in accordance with a control action [page 3, lines 28-29] to move the actuator [page 12, line 28; 6, Fig. 2A] to a predetermined first open valve position [page 3, lines 16-17] specified by a first setpoint value [page 12, lines 30-31; $S_{setpoint}$, Fig. 2A] and charging and/or discharging the actuator [page 12, line 28; 6, Fig. 2A] in accordance with the control action [page 3, lines 28-29] to move the actuator [page 12, line 28; 6, Fig. 2A] from the first open valve position [page 3, lines 16-17] to a predetermined second open valve position [page 3, lines 16-17] specified by a second setpoint

value [page 12, lines 30-31; $S_{setpoint}$, Fig. 2A] such that the actuator [page 12, line 28; 6, Fig. 2A] is not substantially completely discharged [page 5, lines 1-4 and page 2, lines 25-29] while moving from the first open valve position [page 3, lines 16-17] to the second open valve position [page 3, lines 16-17], the first open valve position [page 3, lines 16-17] corresponding to a charge state [page 3, line 26], and the second open valve position [page 3, lines 16-17] corresponding to a further charge state [page 3, line 26];

during an idle time [page 4, lines 17-18] between two consecutive chargings or discharging [page 4, line 18], determining a controlled variable [page 5, lines 17-18] reflecting a charge state [page 3, line 26] of the actuator [page 12, line 28; 6, Fig. 2A] and/or a valve position;

acquiring an external measured variable [page 7, line 26] in the form of a pressure [page 7, line 30] at the valve; and

during an idle time [page 4, line 27] between two consecutive chargings or discharging [page 4, line 27], regulating the control action [page 3, lines 28-29] in dependence on the controlled variable [page 5, lines 17-18] and, additionally [page 7, line 33-

page 8, line 2], on the external measured variable [page 7, line 26].

Independent claim 19 reads as follows:

A control device [page 12, lines 24-25; 4, Fig. 1] for at least one valve actuator [page 12, line 28; 6, Fig. 2A], the control device [page 12, lines 24-25; 4, Fig. 1] comprising:

a controller [page 12, line 31; 5, Fig. 2A] configured to charge and/or discharge [page 12, lines 27-28] the actuator [page 12, line 28; 6, Fig. 2A] in accordance with a control action [page 3, lines 28-29] to move the actuator [page 12, line 28; 6, Fig. 2A] to a predetermined first open valve position [page 3, lines 16-17] specified by a first setpoint value [page 12, lines 30-31; $S_{setpoint}$, Fig. 2A] and to charge and/or discharge the actuator [page 12, line 28; 6, Fig. 2A] in accordance with the control action [page 3, lines 28-29] to move the actuator [page 12, line 28; 6, Fig. 2A] from the first open valve position [page 3, lines 16-17] to a predetermined second open valve position [page 3, line 17] specified by a second setpoint value [page 12, lines 30-31; $S_{setpoint}$, Fig. 2A] such that the actuator [page 12, line 28; 6, Fig. 2A] is not substantially completely

discharged [page 5, lines 1-4 and page 2, lines 25-29] while moving from the first open valve position [page 3, lines 16-17] to the second open valve position [page 3, lines 16-17], the first open valve position [page 3, lines 16-17] corresponding to a charge state [page 3, line 26], and the second open valve position [page 3, lines 16-17] corresponding to a further charge state [page 3, line 26], said controller being characterized by the control action [page 3, lines 28-29]; and

a closed-loop control regulator [page 13, line 6; 7, Fig. 2A] connected to said controller [page 12, line 31; 5, Fig. 2A] for adapting the control action [page 3, lines 28-29] of said controller [page 12, line 31; 5, Fig. 2A];

said regulator [page 13, line 6; 7, Fig. 2A] having an input [Fig. 2A] connected to the actuator [page 12, line 28; 6, Fig. 2A] and/or to the valve in order to acquire a first controlled variable [page 5, lines 17-18];

the controlled variable [page 5, lines 17-18] reflecting a charge state [page 3, line 26] of the actuator [page 12, line 28; 6, Fig. 2A] and/or a valve position; and

said regulator [page 13, line 6; 7, Fig. 2A] being configured to acquire the controlled variable [page 5, lines 17-18] discontinuously during idle times in each case and adjusting the control action [page 3, lines 28-29] discontinuously in idle times in each case;

said regulator [page 13, line 6; 7, Fig. 2A] having an input [Fig. 2A] connected to at least one sensor for detecting a pressure [page 7, line 30] at the valve wherein the pressure [page 7, line 30] defines a second controlled variable [page 5, lines 17-18].

Grounds of Rejection to be Reviewed on Appeal

1. Whether or not claims 10-28 are obvious over U.S. published patent application No. 2002/0011762 to Klenk et al. in view of DE 19944733 to Schrod (US Patent No. 6,563,252 being used as an English equivalent), and further in view of US patent No. 5,479,902 to Wirbeleit et al. under 35 U.S.C. § 103.

Argument:

Claims 10-28 are not obvious over Klenk et al. in view of Schrod and further in view of Wirbeleit et al. under 35 U.S.C. § 103

Appellants respectfully disagree with the Examiner's assessment of the teaching in Wirbeleit et al. As will be explained below, since Wirbeleit et al. do not teach the claimed limitations for which it has been cited, even if one of ordinary skill in the art did consider the teachings in Klenk et al., Schrod, and Wirbeleit et al., the invention as defined by claims 10 and 19 would not have been suggested.

Claim 10 defines a control method for a valve actuator that includes steps of:

> charging and/or discharging the actuator in accordance with a control action to move the actuator to a predetermined first open valve position ...;
>
> acquiring an external measured variable in the form of a pressure at the valve; and

> during an idle time between two consecutive chargings or dischargings, regulating the control action in dependence on the controlled variable and, additionally, on the external measured variable.

The Examiner has alleged that Wirbeleit et al. teach such steps. In particular, the Examiner has alleged that Wirbeleit et al. teach acquiring a measured variable in the form of a pressure at an injection valve and regulating the control action in dependence on the pressure. Appellants respectfully disagree.

In fact, Wirbeleit et al. specifically teach that the actuator is charged and discharged in a manner that is independent of the injection pressure, and this is exactly the opposite of what is claimed. This can clearly be seen by referring to column 1, lines 63-67 of Wirbeleit et al., which teaches: "As a result of the particular arrangement of the pressure compensation piston with the slot-like injection orifice, the orifice can be opened independently of the fuel pressure solely against the closing force of the spring provided in the injector." One can also refer to column 1, lines 37-41 of Wirbeleit et al., which teaches that the

object of their invention is to select the injection time independently of the level of the fuel injection pressure.

Clearly, Wirbeleit et al. teach that the particular arrangement of the pressure compensation piston 10 enables the orifice control needle 5 to be opened independently from the fuel pressure (column 1, lines 59-67). The provision of the pressure compensation piston 10 achieves the exact opposite of what is defined in claim 10.

Further, contrary to claim 10, Wirbeleit et al. do not teach acquiring an external measured variable in the form of a pressure at the valve. The Examiner has alleged that the pressure in the pressure chamber 13 is measured by the needle position sensor 19. The needle position sensor 19 only detects the position of the pressure compensation piston 10 in order to detect the position of the orifice control needle 5 (column 2, lines 56-59). The position of the orifice control needle 5 does not provide an indication of the pressure in the pressure chamber 13. The figure does show an arrow running from the supply conduit 3 to the control unit 20. However, the purpose of this connection is not disclosed. Wirbeleit et al. do not teach detecting a pressure at the

valve, but rather teach detecting the position of the orifice control needle 5.

In the Advisory action dated September 21, 2009, the Examiner continues to allege that the needle position sensor 19 acquires an external measured variable in the form of a pressure at the valve. Wirbeleit et al. very clearly teaches that the needle position sensor 19 senses the position of the orifice control needle 5. The needle position sensor 19 provides a measured variable in the form of position information. Appellants believe that one of ordinary skill in the art would not consider a measured variable in the form of position information to be a measured variable in the form of a pressure at the valve. Even if the measured variable in the form of position information could somehow be subsequently manipulated to provide an indication of a pressure at the valve, Wirbeleit et al. do not teach any reason for doing such a thing and in fact teach against doing so. Wirbeleit et al. is concerned with the position of the orifice control needle 5 and they want to open the orifice control needle 5 independently from the fuel pressure.

Since Wirbeleit et al. do not teach the steps discussed above, even if there were a suggestion to combine the teachings in the cited references for some reason, the invention as defined by claim 10 would not have been suggested.

Now let us consider claim 19. With regard to claim 19 the Examiner has stated that Wirbeleit teaches it was known in the art at the time of the invention to use a similar regulator (20) having an input connected to at least one pressure sensor for detecting a pressure at the valve.

With regard to claim 19, the Examiner has also stated: "To more accurately control the amount of fuel injected using Klenk's actuator, it would have been obvious to regulate the control action (applied voltage) in response to fuel pressure, as taught by Wirbeleit."

However, contrary to the assertions of the Examiner, Wirbeleit et al. specifically teach that the actuator is charged and discharged in a manner that is <u>independent of the injection pressure</u>, and this is exactly the opposite of what is claimed. This can clearly be seen by referring to column 1, lines 63-67 of Wirbeleit et al., which teaches: "As a result

of the particular arrangement of the pressure compensation piston with the slot-like injection orifice, the orifice can be opened independently of the fuel pressure solely against the closing force of the spring provided in the injector." One can also refer to column 1, lines 37-41 of Wirbeleit et al., which teaches that the object of their invention is to select the injection time independently of the level of the fuel injection pressure.

Clearly, Wirbeleit et al. teach that the particular arrangement of the pressure compensation piston 10 enables the orifice control needle 5 to be opened independently from the fuel pressure (column 1, lines 59-67). The provision of the pressure compensation piston 10 achieves the exact opposite of what is defined in claim 19.

Contrary to claim 19, Wirbeleit et al. do not teach: a regulator having an input connected to at least one sensor for detecting a pressure at the valve wherein the pressure defines a second controlled variable.

The Examiner has alleged that the pressure in the pressure chamber 13 is measured by the needle position sensor 19. The needle position sensor 19 only detects the position of the pressure compensation

piston 10 in order to detect the position of the orifice control needle 5 (column 2, lines 56-59). The position of the orifice control needle 5 does not provide an indication of the pressure in the pressure chamber 13. The figure does show an arrow running from the supply conduit 3 to the control unit 20. Wirbeleit et al. do not teach detecting a pressure at the valve, but rather teach detecting the position of the orifice control needle 5.

In the Advisory action dated September 21, 2009, the Examiner continues to allege that the needle position sensor 19 acquires an external measured variable in the form of a pressure at the valve. Wirbeleit et al. very clearly teaches that the needle position sensor 19 senses the position of the orifice control needle 5. The needle position sensor 19 provides a measured variable in the form of position information. Appellants believe that one of ordinary skill in the art would not consider a measured variable in the form of position information to be a measured variable in the form of a pressure at the valve. Even if the measured variable in the form of position information could somehow be subsequently manipulated to provide an indication of a pressure at the valve, Wirbeleit et al. do not teach any reason for doing such a thing and in fact teach against doing so.

Wirbeleit et al. is concerned with the position of the orifice control needle 5 and they want to open the orifice control needle 5 independently from the fuel pressure.

Since Wirbeleit et al. do not teach the limitations discussed above, even if there were a suggestion to combine the teachings in the cited references for some reason, the invention as defined by claim 19 would not have been suggested.

The honorable Board is therefore respectfully urged to reverse the final rejection of the Primary Examiner.

If an extension of time is required for this submission, petition for extension is herewith made. Any fees due should be charged to Deposit Account No. 12-1099 of Lerner Greenberg Stemer LLP.

Respectfully submitted,

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Date: November 6, 2009

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Claims Appendix:

10. A control method for a valve actuator, which comprises the following steps:

charging and/or discharging the actuator in accordance with a control action to move the actuator to a predetermined first open valve position specified by a first setpoint value and charging and/or discharging the actuator in accordance with the control action to move the actuator from the first open valve position to a predetermined second open valve position specified by a second setpoint value such that the actuator is not substantially completely discharged while moving from the first open valve position to the second open valve position, the first open valve position corresponding to a charge state, and the second open valve position corresponding to a further charge state;

during an idle time between two consecutive chargings or dischargings, determining a controlled variable reflecting a charge state of the actuator and/or a valve position;

acquiring an external measured variable in the form of a pressure at the valve; and

during an idle time between two consecutive chargings or dischargings, regulating the control action in dependence on the controlled variable and, additionally, on the external measured variable.

11. The control method according to claim 10, wherein at least one valve position selected from the group consisting of the first open valve position and the second open valve position is a partially open valve position.

12. The control method according to claim 10, which comprises determining the controlled variable by measuring a voltage across the actuator and/or a charge of the actuator.

13. The control method according to claim 10, which comprises determining the control action for charging and/or discharging by a specified charging characteristic and/or discharging characteristic having a specified shape and steepness.

14. The control method according to claim 13, which comprises adjusting the steepness of the charging characteristic and/or of the discharging characteristic as part of the regulating step.

15. The control method according to claim 13, which comprises adjusting the shape of the charging characteristic and/or of the discharging characteristic as part of the regulating step.

16. The control method according to claim 10, which comprises determining the control action by the charging duration and/or the discharging duration, wherein the charging duration and/or the discharging duration are adjusted as part of the regulating step.

17. The control method according to claim 10, wherein the valve actuator is a piezoelectric actuator and the valve is an injection valve for an internal combustion engine.

18. The control method according to claim 10, wherein the regulating step is a closed-loop control step.

19. A control device for at least one valve actuator, the control device comprising:

a controller configured to charge and/or discharge the actuator in accordance with a control action to move the actuator to a predetermined first open valve position specified by a first setpoint value and to charge and/or discharge the actuator in accordance with the control action to move the actuator from the first open valve position to a predetermined second open valve position specified by a second setpoint value such that the actuator is not substantially completely discharged while moving from the first open valve position to the second open valve position, the first open valve position corresponding to a charge state, and the second open valve position corresponding to a further charge state, said controller being characterized by the control action; and

a closed-loop control regulator connected to said controller for adapting the control action of said controller;

said regulator having an input connected to the actuator and/or to the valve in order to acquire a first controlled variable;

the controlled variable reflecting a charge state of the actuator and/or a valve position; and

said regulator being configured to acquire the controlled variable discontinuously during idle times in each case and adjusting the control action discontinuously in idle times in each case;

said regulator having an input connected to at least one sensor for detecting a pressure at the valve wherein the pressure defines a second controlled variable.

20. The device according to claim 19, wherein said regulator is superimposed on said controller.

21. The device according to claim 19, wherein the valve actuator is a piezoelectric actuator and the valve is an injection valve of an internal combustion engine.

22. The device according to claim 19, wherein the actuator is exclusively charged in order to move from the first open valve position to the second open valve position.

23. The device according to claim 19, wherein the actuator is exclusively discharged in order to move from the first open valve position to the second open valve position.

24. The control method according to claim 10, wherein the actuator is exclusively charged in order to move from the first open valve position to the second open valve position.

25. The control method according to claim 10, wherein the actuator is exclusively discharged in order to move from the first open valve position to the second open valve position.

26. The control method according to claim 10, wherein the control action, which has been regulated in dependence on the controlled variable and the external measured variable, takes effect when a subsequent setpoint value is used to specify a subsequent open valve position.

27. The device according to claim 19, wherein the control action, which has been adapted by said regulator, takes effect when a

subsequent setpoint value is used to specify a subsequent open valve position.

28. The control method according to claim 10, which comprises discharging the actuator in accordance with the control action, and determining the control action for the discharging by a specified discharging characteristic, wherein the discharging characteristic has a specified shape and steepness.

Evidence Appendix:

No evidence pursuant to §§ 1.130, 1.131, or 1.132 or any other evidence has been entered by the Examiner and relied upon by appellant in the appeal.

Related Proceedings Appendix:

No prior or pending appeals, interferences or judicial proceedings are in existence which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in this appeal. Accordingly, no copies of decisions rendered by a court or the Board are available.